(12) UK Patent Application (19) GB (11) 2 300 732 (13) A

(43) Date of A Publication 13.11.1996

(21) Application No 9509832.7

(22) Date of Filing 12.05.1995

(71) Applicant(s)
Standard Products Limited

(Incorporated in the United Kingdom)

Dryden House, St Johns Street, HUNTINGDON, Cambs, PE18 6NU, United Kingdom

(72) Inventor(s)
Alan Charles Bickley

(74) Agent and/or Address for Service
Haseltine Lake & Co
Hazlitt House, 28 Southampton Buildings, Chancery Lane, LONDON, WC2A 1AT, United Kingdom

(51) INT CL[6]
E05F 15/00

(52) UK CL (Edition O)
G3N NGCA4B N286C
U1S S1856

(56) Documents Cited
US 4943757 A

(58) Field of Search
UK CL (Edition N) E2M MAB , G3N NGCA4B NG2
INT CL[6] E05F 15/00 15/16

(54) Window sealing system with piezo-electric cable anti-trap sensor

(57) A window sealing system (8) with provision to prevent an object from being dangerously trapped by a closing window pane (16) comprises

a mounting portion (9) which is relatively rigid;

a sealing element (14) capable of abutting a window pane (16) when the latter is in a closed position;

a hollow bulbous portion (17), as viewed in cross-section, carried by the mounting portion (9), the bulbous portion (17) being relatively flexible compared to the mounting portion (9); and

an elongate sensor (20) comprising a piezo-electric cable secured in a channel (19) provided in a region of the bulbous portion (17) remote from the mounting portion (9), the sensor (20) being connectable to external circuitry for controlling movement of the window pane (16);

the arrangement being such that, in use, in the event of an object being struck by a closing window pane (16), the object strikes the bulbous portion (17) which activates the piezo-electric cable to generate a signal to the external circuitry to stop and then reverse the motor, before the object is forced as far as the rigid mounting portion (9).

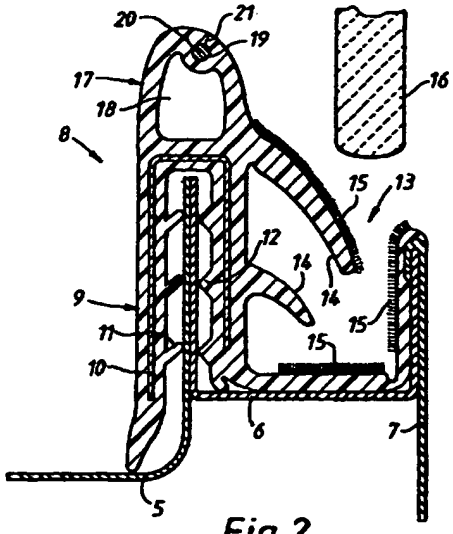

Fig.2

GB 2 300 732 A

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

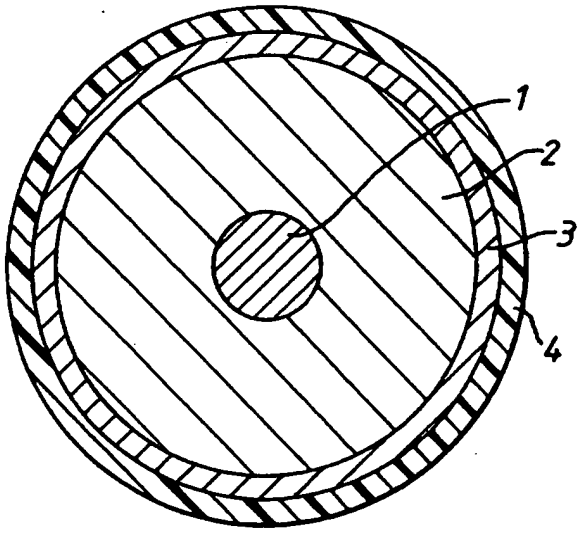

Fig. 1

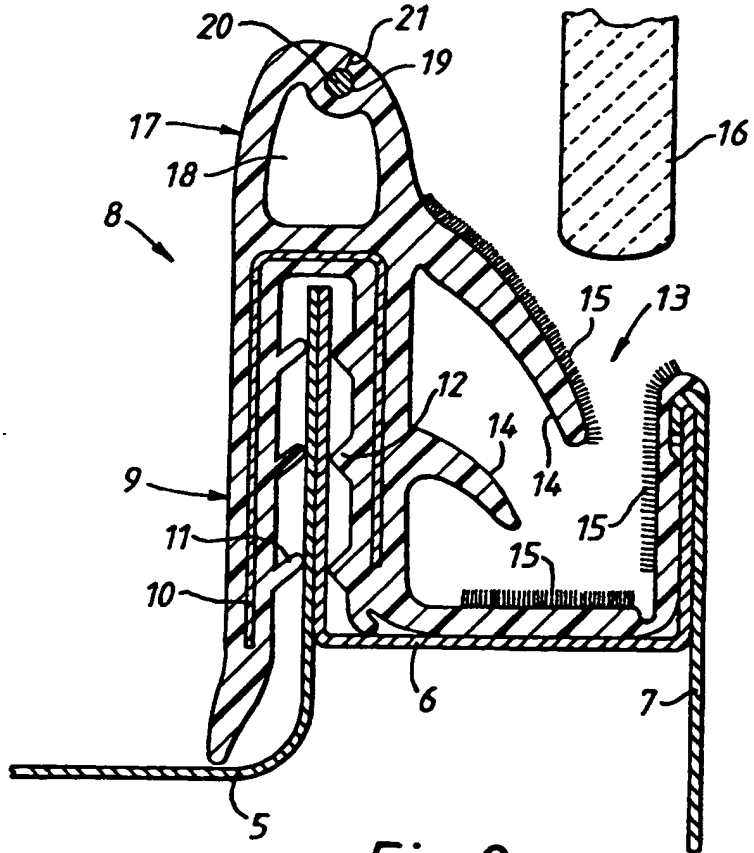

Fig. 2

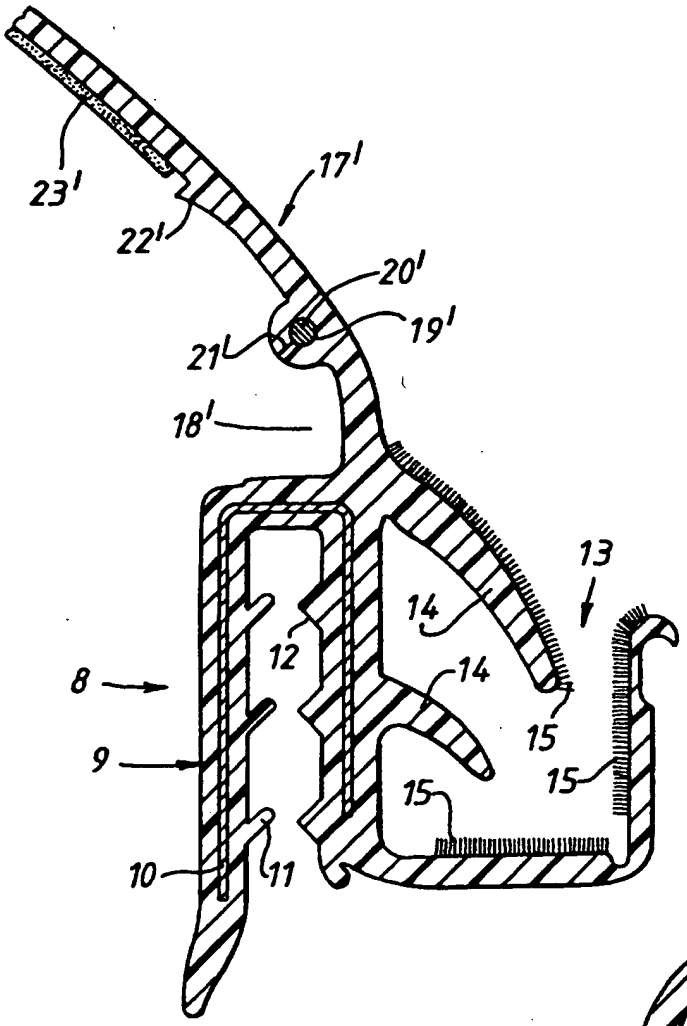

Fig. 3

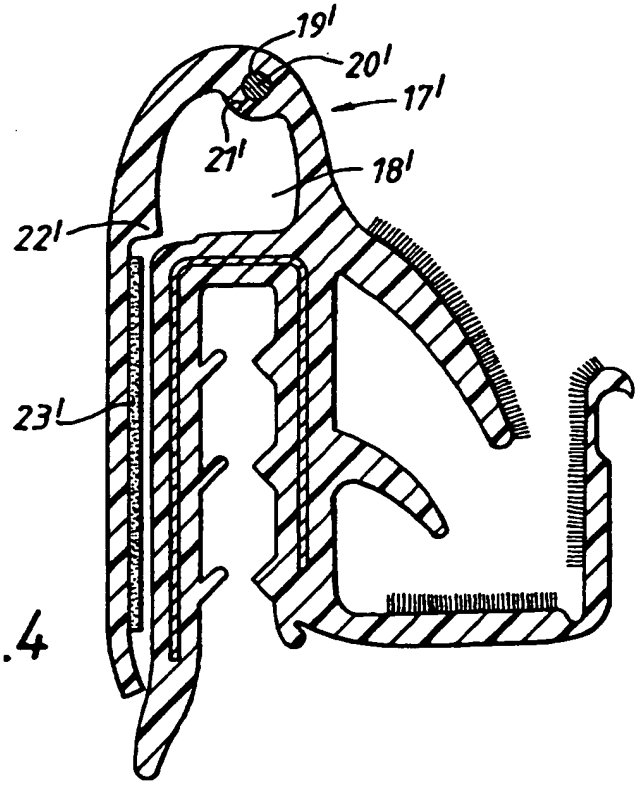

Fig. 4

WINDOW SEALING SYSTEM WITH PIEZO-ELECTRIC CABLE ANTI-TRAP SENSOR

This invention relates to a window sealing system with a piezo-electric cable anti-trap sensor.

It is known that piezo-electric cables can be employed as sensors. A typical piezo-electric cable has a wire core, outside which is a layer of piezo-electric material, outside which is a metal braid or other form of electrode, with an electrically insulating polymeric jacket being outermost of all. When such a cable is subjected to applied force, bent or stretched, the piezo-electric material is deformed - leading to an electric charge separation across the material. This charge separation can be detected as a difference in potential between the wire core and the outer electrode (or braid) and this can be interpreted by external circuitry.

An example of piezo-electric material is polyvinylidene fluoride, or a mixture of piezo-electric crystals in an elastomer.

The sensor of this type could be mounted in or near a glass run channel for a window pane of an automobile, to provide anti-trap protection. Such an anti-trap system could be used to prevent undue injury being caused in the event of, for example, a finger being caught between a rising glass pane and the window frame. Once the trap has been detected, the circuitry can ensure that the current to the motor is reversed so that the glass backs off quickly before excessive force is applied for too long to the trapped article. Understandably, the cable must be mounted in an area where it will be exposed to the applied force during a trap situation.

According to the present invention there is provided a window sealing system with provision to prevent an object from being dangerously trapped by a

closing window pane, the system comprising:

a mounting portion which is relatively rigid;

a sealing element capable of abutting a window pane when the latter is in a closed position;

a hollow bulbous portion, as viewed in cross-section, carried by the mounting portion, the bulbous portion being relatively flexible compared to the mounting portion; and

an elongate sensor comprising a piezo-electric cable secured in a channel provided in a region of the bulbous portion remote from the mounting portion, the sensor being connectable to external circuitry for controlling movement of the window pane;

the arrangement being such that, in use, in the event of an object being struck by a closing window pane, the object strikes the bulbous portion which activates the piezo-electric cable to generate a signal to the external circuitry to stop and then reverse the motor, before the object is forced as far as the rigid mounting portion.

In practice it can be appreciated that when an object is trapped between the window pane and the sealing system, then the bulbous portion is deformed which causes the cable thereby to be bent/stretched, and the resulting signal is used to stop and then reverse the electric motor so as to release the trap. However, because of the time it takes for the electronic circuitry to react to the sensor signal and in view of the inertia of the system, the force on the trapped article would normally continue to rise in known arrangements. In the present case, however, because the piezo-electric cable is mounted on the bulbous portion, then although the window pane continues for a short while to move towards it closed position, the build-up of force is kept to a minimum. It is the provision of the bulbous portion which can

accommodate the conventional over-travel feature of the window pane, whilst importantly keeping the trap forces low.

In the manufacture of a window sealing system in accordance with the present invention the piezo-electric cable can be located in, and secured in, the channel in the bulbous portion, in a region remote from the mounting portion, after the main mounting portion, sealing element and bulbous portion have been formed i.e. extruded, moulded etc.. This production route has the advantage that piezo-electric cables which cannot withstand the processing temperatures of the elastomers normally employed in window sealing systems, can be used. This permits cheaper piezo-electric cables to be employed.

The piezo-electric cable can be inserted into the channel provided in that region of the bulbous portion remote from the mounting portion by a longitudinally-extending slit from the exterior of the bulbous portion to the channel such that, once the elongate sensor has been located in the channel, the opposing sides of the slit can be joined with a suitable adhesive, but this has the disadvantage that a witness line of the joint will be visible.

An alternative procedure involves extruding the sealing system (but not the elongate sensor) with an extension on one wall region of the bulbous portion being in a free mode, and with the slit (for allowing entry of the elongate sensor into the channel) in a region which ultimately will be on the interior of the bulbous portion. Then, with the wall portion still free the sensor is located in and secured in the channel, after which the extension of the wall region of the bulbous portion is secured to another part of the sealing system, for example one part of the mounting portion, so as to leave the bulbous portion

having the piezo-electric cable securely located in a region remote from the mounting portion.

In addition to the bulbous portion accommodating the inevitable over-travel of the window pane while still managing to restrict the force to a low force, the sensor forming part of the present invention is sensitive to forces applied from any direction rather than merely in the direction of closing movement of the window pane.

For a better understanding of the present invention and to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying drawings, in which:

Figure 1 is the cross-section on an enlarged scale through a typical piezo-electric cable;

Figure 2 is a cross-section through one embodiment of window sealing system in accordance with the present invention mounted on suitable panel components for an automobile;

Figure 3 is a cross-section through a different embodiment of window sealing system in accordance with the present invention in the form after it has been extruded and before the temporarily free wall region of the bulbous portion has been secured to their mounting portion; and

Figure 4 shows the window sealing system of Figure 3 but with the previously free end region of the bulbous portion secured adjacent the relatively rigid mounting portion.

Referring firstly to Figure 1 the illustrated piezo-electric cable, which typically has a diameter in the range of 2 to 4 mm, has at its centre a wire core 1 outside which is a layer 2 of a piezo-electric material outside which is conductive braid of material 3, outside which at the surface is a polymeric jacket 4 formed of insulating material.

With regard to Figure 2 first, second and third metallic body components 5, 6 and 7 of an automobile are shown. The first and second components 5, 6 serve to form a flange and the second and third components 6, 7 define a channel intended to accommodate a glass run channel of the sealing system. The sealing system is generally indicated by the reference numeral 8 and the system 8 includes a mounting portion 9 formed of an elastomeric material embedded in which is a steel reinforcing core 10, the mounting portion 9 being formed with traditional ribs 11 and protuberances 12 to enable the mounting portion 9 to be securely fitted on the flange 5, 6. On the opposite side of the sealing system 8 is a glass run channel 13 defined by other elastomeric components and provided with sealing lips 14, with those regions which are likely to contact a glass pane 16 being provided with flock 15.

Also provided in the sealing system 8 is a bulbous portion generally indicated by the reference numeral 17 which includes a large hollow region 18. A part of the bulbous portion 17 remote from the mounting portion 9 is provided with a channel 19 securely located in which is a piezo-electric cable 20 which has been fitted into the channel 19, through a slit 21 which, once the cable 20 has been secured in the channel 19, has been sealed, for example with a suitable adhesive. The provision of the cable 20 after the rest of the sealing system has been formed allows a piezo-electric cable 20 to be employed which might otherwise be damaged by high temperatures associated with extrusion. A slight disadvantage of the embodiment illustrated in Figure 2 is that the slit 20, even though carefully sealed, slightly disfigures the overall appearance.

In use of the embodiment illustrated in Figure 2, if an object such as a finger is near the sealing system as the glass pane 16 advances towards the glass

run channel 13 the object will be caused to strike the bulbous portion 17 which will cause bending or stretching to be applied to the cable 20 which can generate a signal to operate the external circuitry to cause the electric motor powering the window pane to stop and then reverse. This action however takes a finite amount of time and the window pane 16 will continue, at least for a short time, to move towards the glass run channel 13. However, in view of the flexible nature of the bulbous portion, further movement of the trapped article towards the relatively rigid mounting portion 9 can be safely accommodated by the collapse of the bulbous portion 17.

Turning now to Figure 3, generally speaking most of the features shown therein correspond to the correspondingly numbered components shown in Figure 2. However, the side wall region of the bulbous portion 17' which is to enclose the hollow region 18' carries an abutment 22' and, beyond that, some double-sided adhesive tape 23'. Another difference is that the slit 21' which allows access to the channel 19' for the cable 20' is on what will be the interior of the hollow portion 17'. The advantage of this is that the cable 20' can be inserted in the channel 19' and then the slit 21' sealed, after which the free end region of the wall part of the bulbous region 17' can be curved round and secured in position beside part of the rigid mounting member 9 by action of the double-sided adhesive tape 23', although it will be appreciated that some other form of adhesive or some other form of force fitting could be employed. The advantage of the arrangement which results, as shown in Figure 4, is that the slit 21' is no longer visible from the exterior of the window sealing system.

CLAIMS

1. A window sealing system with provision to prevent an object from being dangerously trapped by a closing window pane, the system comprising:

a mounting portion which is relatively rigid;

a sealing element capable of abutting a window pane when the latter is in a closed position;

a hollow bulbous portion, as viewed in cross-section, carried by the mounting portion, the bulbous portion being relatively flexible compared to the mounting portion; and

an elongate sensor comprising a piezo-electric cable secured in a channel provided in a region of the bulbous portion remote from the mounting portion, the sensor being connectable to external circuitry for controlling movement of the window pane;

the arrangement being such that, in use, in the event of an object being struck by a closing window pane, the object strikes the bulbous portion which activates the piezo-electric cable to generate a signal to the external circuitry to stop and then reverse the motor, before the object is forced as far as the rigid mounting portion.

2. A window sealing system according to claim 1, wherein adjacent the channel is a slit to allow the elongate sensor to be introduced into the channel, the slit being sealed to prevent escape of the elongate sensor from the channel.

3. A window sealing system according to claim 2, wherein the sealed slit is on an external surface of the bulbous portion.

4. A window sealing system according to claim 2, wherein the sealed slit faces the hollow interior of the bulbous portion.

5. A window sealing system according to claim 4, wherein a wall region of the bulbous portion is

provided with an extension which is secured to another part of the sealing system.

6. A window sealing system according to claim 5, wherein the extension is secured to the mounting portion.

7. A window sealing system according to any preceding claim, wherein the sealing element is a flexible lip optionally associated with a glass run channel.

8. A window sealing system substantially as hereinbefore described with reference to, and as illustrated in, Figure 2 or in Figures 3 and 4 of the accompanying drawings.

9. A motor vehicle fitted with a window sealing system as claimed in any preceding claim, wherein the sensor is connected to circuitry for controlling movement of the window pane.

10. A method for the manufacture of a window sealing system in accordance with claim 1, wherein the piezo-electric cable can be located in, and secured in, the channel in the bulbous portion, in a region remote from the mounting portion, after the main mounting portion, sealing element and bulbous portion have been formed.

11. A method according to claim 10, wherein the piezo-electric cable is inserted into the channel provided in that region of the bulbous portion remote from the mounting portion by a longitudinally-extending slit from the exterior of the bulbous portion to the channel and wherein, once the piezo-electric cable has been located in the channel, the opposing sides of the slit are joined with a suitable adhesive.

12. A method according to claim 10, which includes extruding the sealing system (but not the elongate sensor) with an extension on one wall region of the bulbous portion being left in a free mode, and

with the slit (for allowing entry of the elongate sensor into the channel) in a region which ultimately will be on the interior of the bulbous portion; then, with the wall region still free, the sensor is located in and secured in the channel; after which the extension of the wall region of the bulbous portion is secured to another part of the sealing system, so as to leave the bulbous portion having the piezo-electric cable securely located in a region remote from the mounting portion.

10

Patents Act 1977 Examiner's report to the Comptroller under Section 17 (The Search report)	Application number GB 9509632.7
Relevant Technical Fields (i) UK Cl (Ed.N) G3N (NGZ, NGC, A4B) E2M (MAB) (ii) Int Cl (Ed.6) E05F (15/00, 15/16)	Search Examiner MR D A SIMPSON Date of completion of Search 18 JULY 1995
Databases (see below) (i) UK Patent Office collections of GB, EP, WO and US patent specifications. (ii)	Documents considered relevant following a search in respect of Claims :- 1 TO 12

Categories of documents

X:	Document indicating lack of novelty or of inventive step.	P:	Document published on or after the declared priority date but before the filing date of the present application.
Y:	Document indicating lack of inventive step if combined with one or more other documents of the same category.	E:	Patent document published on or after, but with priority date earlier than, the filing date of the present application.
A:	Document indicating technological background and/or state of the art.	&:	Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages	Relevant to claim(s)
X	US 4943757 (KABILMETAL) column 2 line 28 to line 31	1, 7, 9

Databases: The UK Patent Office database comprises classified collections of GB, EP, WO and US patent specifications as outlined periodically in the Official Journal (Patents). The on-line databases considered for search are also listed periodically in the Official Journal (Patents).